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# Paper
# Temporal patterns in cervical cancer incidence and survival in urban Shanghai

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*Age-adjusted cervical cancer incidence rates in urban Shanghai have declined dramatically in recent decades. Using data from the Shanghai Cancer Registry, we examined in more detail the incidence patterns and survival rates. Based on more than 7000 cases of cervical cancer diagnosed during 1972–94 among female residents of the ten urban areas, rates declined from 26.7/100 000 in 1972–74 to 2.4/100 000 in 1993–94, dropping in rank from 1st to 15th among all cancers among females. Decreases occurred in all age groups and approached 90% among women aged 35–64. A cervical cytology program was implemented in Shanghai in the late 1950s. The wide availability of Pap smears and treatment for cervical precursor lesions and improved personal hygiene are responsible for the large reductions in incidence. Survival rates for younger and middle-aged women were better than those for older women. Survival rates decreased over time, most likely related to the aggressive natural history of an increasing proportion of the clinically diagnosed invasive cervical cancers that escaped detection by screening. Continued detection of early-stage cases by systemic cytology screening and improved treatment are needed to lower incidence further and enhance the survival of women with cervical cancer in Shanghai.*

**Keywords:** *cervical cancer; incidence; urban Shanghai; survival*

## Introduction

Cervical cancer is the third most common cancer diagnosed among women worldwide, accounting for 9.8% of all cancer cases during 1990.[1] As recently as 1985, it was the second most frequent cancer among women.[2] From 1980 to 1990, the estimated annual number of cases worldwide declined 20%, from 465 600 to 371 000.[1,3] The largest contribution to this change was the decline in the estimate for China. Age-adjusted mortality rates for cervical cancer in China decreased 68.4% from 1973–75 to 1990–92.[4]

Age-adjusted incidence rates for cervical cancer have declined dramatically over the last 20 years in urban Shanghai.[5] Using data from the Shanghai Cancer Registry, we examined in greater detail the incidence trends and survival rates for cervical cancer cases diagnosed during 1972–94, in the hope that they might point to further etiologic leads.

## Materials and methods

The materials and methods used in this analysis have been described in detail elsewhere.[5] Briefly, all medical facilities in Shanghai are required to report all newly diagnosed cancer cases to the Shanghai Cancer Registry, which has essentially complete coverage of all incident cancer cases diagnosed since 1972. The population of the ten districts comprising the urban area was 7.3 million people in 1992. Patients newly diagnosed during 1972–94 with cancer of the cervix (ICD-9 code 180)[6] were included in this study.

Age-specific annual rates for seven 3-year periods (1972–74 to 1990–92) and one 2-year period (1993–94) were assembled and age-adjusted rates were calculated, using 5-year age groups and adjusting to the world standard population using the direct method. Population estimates were based on periodic census data (1973, 1979, 1982, 1985, 1990, 1992) with age- and sex-specific intercensal estimates derived by linear interpolation for intervening years. Average annual percent changes in incidence were estimated by means of a linear regression of the logarithm of the respective rates on calendar year, weighted by the number of cases.

For the survival analysis, a total of 6380 (88.1%) cervical cancer cases among residents of urban Shanghai diagnosed during 1972–91 were included. Exclusions consisted of cases reported only by a death certificate, cases without any follow-up information, with those with incomplete date of diagnosis or death, and with other incompatible features. Follow-up for this current study ended on 31 December 1994. The index date for calculation of duration of survival was the date of diagnosis. The survival time for each case was the duration between the

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index date and the date of death or last follow-up. Cumulative observed survival rates were calculated by the life-table method. The cumulative relative survival rates were calculated as a ratio of observed to expected survival rates.[7] Age-standardized relative survival (ASRS) was calculated by direct standardization to the site-specific age distributions of the estimated global incidence of major cancers in 1985[2] in order to facilitate comparison of results with those from other countries.

## Results

A total of 7480 cervical cancer cases were diagnosed among female residents in urban Shanghai during 1972–94. The incidence has been declining rapidly since the mid-1970s (Table 1). Over the period of 1972–74 to 1993–94, the decrease was almost 91% (11.7% per year). Rates declined from 26.7/100 000 in 1972–74 to 2.5/100 000 in 1993–94, dropping in rank from 1st to 15th among all cancers among females.

As shown in Table 2 and Figure 1, cervical cancer rates declined in all age groups. Rates among women aged 35–64 y decreased 90%, more rapidly than the decreases of about 50% among women aged 75 and over.

The cumulative 1-, 2-, 3-, 4- and 5-year observed and relative survival rates for cervical cancer during 1988–91 are given in Table 3. Cervical cancer carries a moderate prognosis, with a 5-year observed survival of 45.0% and a relative survival of 51.9% in urban Shanghai. A 5-year ASRS of 59% was observed for women diagnosed during 1988–91 (not shown).

Table 4 shows the number of cases of cervical cancer and the 5-year relative survival for each age group for three time periods. The overall 5-year relative survival rate declined from 73.5% for patients diagnosed during 1972–79 to 51.9% for patients diagnosed during 1988–91. During each time period, the survival rates for younger and middle-aged women were better than those for older women. Reflecting the declines in incidence, the annual number of cases decreased substantially over time.

**Table 1** Age-adjusted incidence rates[a] of cervical cancer in urban Shanghai, 1972–74 to 1993–94

| *Time period (y)* | *No.* | *Rate* |
|---|---|---|
| 1972–74 | 2581 | 26.7 |
| 1975–77 | 1363 | 13.5 |
| 1978–80 | 942 | 8.4 |
| 1981–83 | 691 | 5.7 |
| 1984–86 | 583 | 4.1 |
| 1987–89 | 529 | 3.5 |
| 1990–92 | 531 | 3.3 |
| 1993–94 | 260 | 2.5 |
| Total percent change | | −90.7 |
| APC[b] | | −11.7[c] |

[a] Per 100 000 person-years, age-adjusted using the world standard population.
[b] Annual percent change.
[c] $P \leq 0.01$.

**Table 2** Age-specific cervical cancer incidence rates[a] in urban Shanghai, 1972–77 to 1990–94

| | *1972–77* | | *1990–94* | | |
|---|---|---|---|---|---|
| *Age group (y)* | *No.* | *Rate* | *No.* | *Rate* | *Percent change* |
| 25–34 | 20 | 1.0 | 14 | 0.4 | −62.9 |
| 35–44 | 354 | 14.3 | 51 | 1.7 | −88.5 |
| 45–54 | 1298 | 54.0 | 60 | 3.8 | −93.0 |
| 55–64 | 1351 | 87.4 | 209 | 10.1 | −88.5 |
| 65–74 | 727 | 82.8 | 299 | 20.7 | −75.0 |
| 75–84 | 175 | 53.0 | 134 | 23.1 | −56.5 |
| 85+ | 13 | 31.1 | 19 | 16.7 | −46.3 |

[a] Per 100 000 person-years.

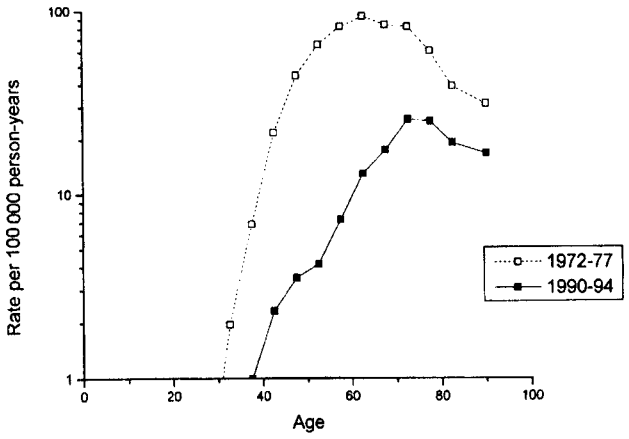


**Figure 1** *Age-specific cervix uteri cancer incidence rates in urban Shanghai, 1972–77 and 1990–94.*

**Table 3** Cervical cancer survival rates in urban Shanghai, 1988–91

| *Number of cases* | *Observed survival rate (%)* | | | | | *Relative survival rate (%)* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1-y* | *2-y* | *3-y* | *4-y* | *5-y* | *1-y* | *2-y* | *3-y* | *4-y* | *5-y* |
| 619 | 73.3 | 59.6 | 53.1 | 48.1 | 45.0 | 75.2 | 62.8 | 57.5 | 53.7 | 51.9 |

## Discussion

As recently as 1985, cervical cancer was the most common cancer of women in developing countries.[2] The incidence rates for cervical cancer in Shanghai, China were also high, ranking 1st among rates for women's cancers in the early 1970s.[5] Since the mid-1970s, however, the rates have declined remarkably, with a decrease of more than 90% from 1972–74 to 1993–94. This reduction was seen in all age groups, particularly among young and middle-aged groups. Around 1990, the age-adjusted rate was 3.3 per 100 000, one of the lowest in the world,[8] and by 1993–94 the rate had dropped further to 2.5 per 100 000.

It is generally accepted that screening has played a major role in the reduction of cervical cancer rates and that areas where screening efforts have been better organized have obtained the most significant reductions in incidence and mortality.[9] In the early 1950s a plan was conceived to introduce a cervical cytology program for the prevention of cervical cancer in Shanghai women. This program was formally implemented in the late 1950s. Cytology screening services have been provided

**Table 4** Cervical cancer 5-year relative survival rates (RSR) by age group and time period in urban Shanghai

| | 1972–79 | | 1980–87 | | 1988–91 | |
|---|---|---|---|---|---|---|
| *Age group (y)* | *No. of cases* | *RSR (%)* | *No. of cases* | *RSR (%)* | *No. of cases* | *RSR (%)* |
| 0–34 | 32 | 72.2 | 11 | 54.7 | 9 | 66.9 |
| 35–44 | 371 | 87.6 | 14 | 72.0 | 21 | 76.7 |
| 45–54 | 1421 | 80.2 | 230 | 71.0 | 47 | 59.5 |
| 55–64 | 1517 | 73.5 | 542 | 66.0 | 189 | 59.7 |
| 65–74 | 786 | 57.5 | 470 | 56.1 | 232 | 46.2 |
| 75+ | 177 | 29.4 | 190 | 40.4 | 121 | 36.7 |
| Total | 4303 | 73.5 | 1457 | 61.5 | 619 | 51.9 |

since 1958 through all maternal and child health centers and municipal and district hospitals with the objective of providing Pap smears every one to two years to all sexually active women in Shanghai.[10] Large changes in sexual behavior and concomitant decreases in the incidence of sexually transmitted diseases have occurred since the 1950s in China. The wide availability of Pap smears and treatment for cervical precursor lesions in many medical facilities of Shanghai as well as improvement in personal hygiene are responsible for the more than 90% reduction in incidence achieved over the last two decades. Infection with human papillomavirus (HPV) is etiologically related to cervical cancer risk in many populations.[11] A study in Shanghai found that 87.5% of 40 cervical smear specimens contained HPV DNA,[12] although the distribution of the types differed somewhat from that seen in other populations.[13]

The 5-year relative survival among cervical cancer patients in Shanghai was 52% in 1988–91. The survival rates decreased with advancing age. Examination of survival rates in the three time periods provides interesting information on the efficacy of the cytology screening program in Shanghai. The successive reduction in the annual average number of cases in the three periods indicates that many invasive cervical cancers were prevented in later years due to the detection and treatment of cervical pre-invasive lesions. The decreasing trend in survival over time is probably either an indication of the aggressive natural history of an increasing proportion of the clinically diagnosed invasive cervical cancers that escaped detection by screening probably due to their short natural histories or the less frequent screening of retired women in later years, which increased the proportion of advanced cases. We are aware of the concern in some circles that the dramatic reduction of invasive cervical incidence observed in Shanghai might be a reflection of misclassification of preinvasive cases as invasive cancer in the early years of cancer registration. While this might have happened in the initial years to an extent, the benefit in terms of reduction in incidence seems largely due to a genuine screening effect.

The 5-year age-standardized relative survival of 59% for 1988–91 in Shanghai is low compared with that seen in the United States (68%) and Europe (61%),[14] probably related to the factors mentioned above.

Continuing detection of early-stage cases by systemic cytology screening among high-risk women and improving treatment are needed to further lower incidence and enhance the survival of women with cervical cancer in Shanghai.

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